

New Developments in Biomass Thermal Energy: *Observations from New England and Upper Austria*

**2011 Biomass Boiler Operator's Summit
August 9, 2011
Kalispell, Montana**

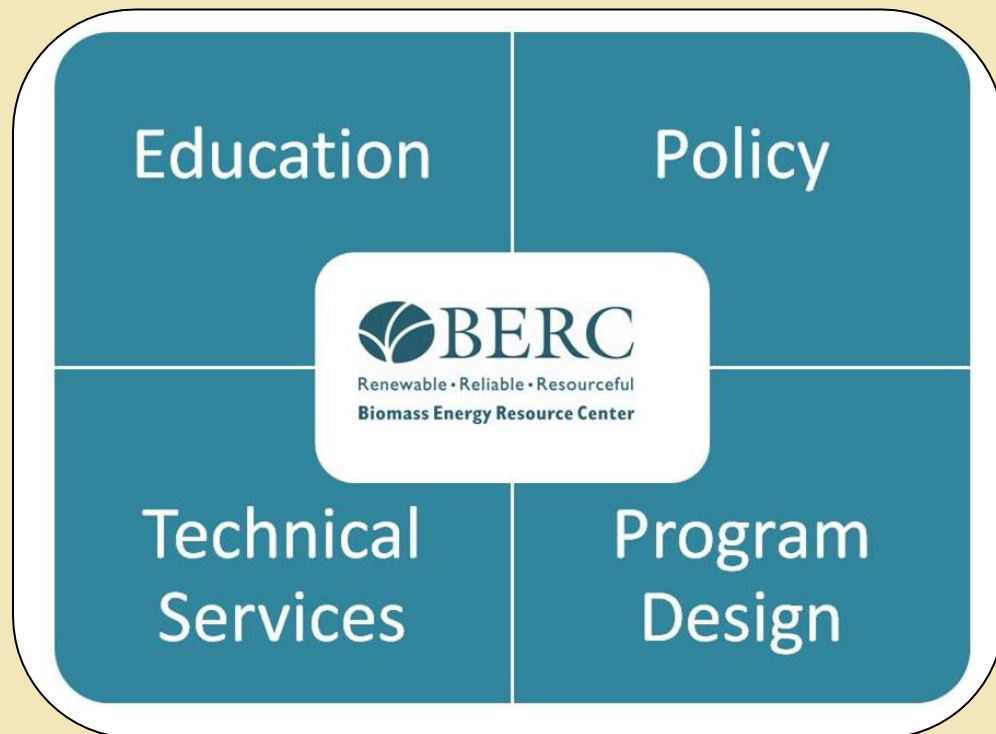
Adam Sherman, Program Director
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Biomass Energy Resource Center (BERC)

Founded in 2001, BERC is a national not-for-profit organization working to promote responsible use of biomass for energy.

BERC's mission is to achieve a healthier environment, strengthen local economies, and increase energy security across the United States by developing sustainable biomass systems at the community scale.

BERC partners include communities, colleges and universities, local state and federal governments, businesses, utilities, schools, institutions, other conservation and energy nonprofits, energy offices, and federal organizations.



Presentation Overview

- Woodchip quality
- Thermal storage
- Integration with other renewables
- Boiler configuration
- Emissions controls
- Containerized units
- Boiler design
- District heating

Screening “Bole” Chips

- “Bole” chips have become the most common heating system wood fuel in the northeast
- Chipped hardwood bolewood at aggregation yard for the heating plant market
- Several key suppliers have installed stationary screening plants to remove overs and fines
- Chips never touch the ground
- More uniform chips and lower ash content



Austrian Chip Contractor

- Aggregated large and small diameter chipwood
- Truck mounted chipper
- Passive solar chip drying bunkers
- Woodchip blower unit with hose discharge
- Mounted on a roll-off truck



Buffer/Accumulator Tanks

- Large hot water storage
- Range widely in size (1,000 – 10,000 gallons per MMBtu/hr of boiler capacity)
- Vertical alignment and stratified zone management
- Shaves peaks and reduces boiler run time in idle/pilot mode
- Applicable from residential to large district heating plants
- Increasingly packaged with boilers by vendors



Solar Hot Water Integration

- Roof top mounted solar hot water panels
- Typically covers woodchip storage roof
- Feeds directly in buffer tank storage and integrates with boiler fed hot water

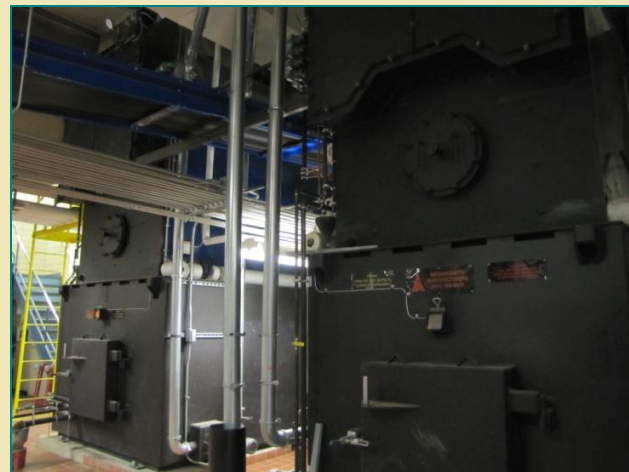


Coupled Boilers

- Typically two parallel boilers (generally 2nd boiler = +/- 1/2 capacity of 1st)
- Better load management in shoulder months and ability to run boilers at full capacity
- Results in better efficiency and cleaner emissions



Apartment building in Wesenufer, Austria



National Life, Montpelier, Vermont



District heating plant in Kirchham, Austria



Crotched Mountain Rehab Center, Greenfield, New Hampshire

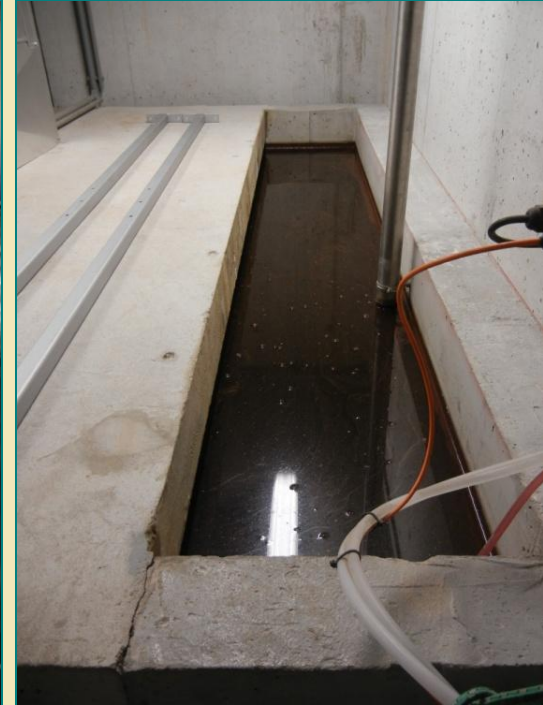
Electro-Static Precipitators

- Previously only cost-effective at very large scale
- Now cost-effective in the >5 MMBtu size range
- Control efficiency of 99% for particulates
- Far better the control efficiencies than cyclones
- Lower O&M costs than bag houses
- Wide spread use in Austria but catching on here in US for woodchip boilers

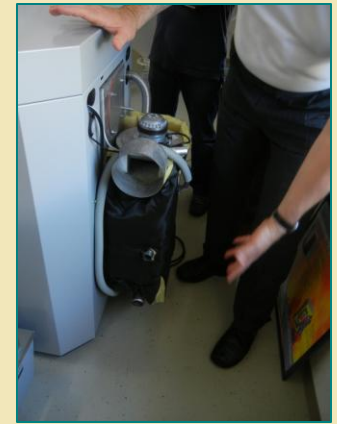


Condensing Units

- Capture and heat recovery of water vapor in stack gases
- Boosts overall thermal efficiency by +/-10%
- Dramatically lowers fine particulate and VOC emissions
- Effective for green wood fuel
- What to do with the water afterwards?



District heating plant in Eugendorf, Austria



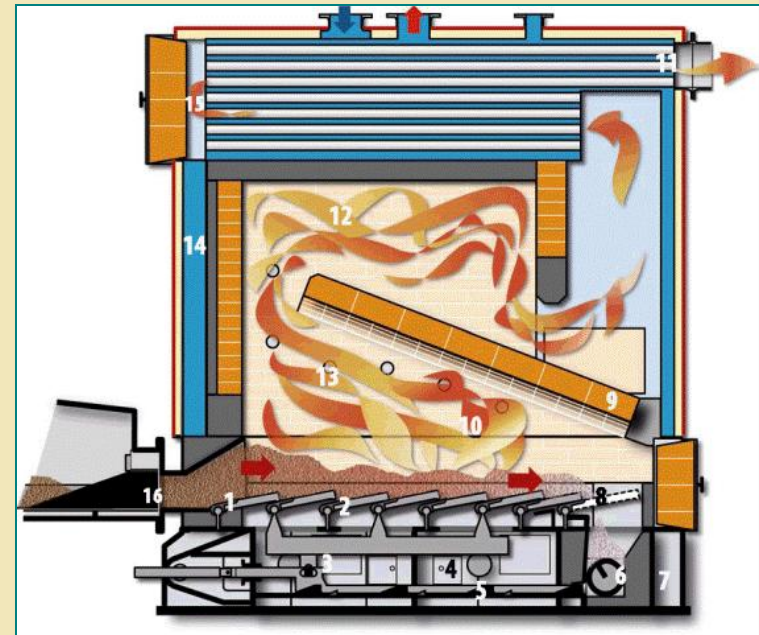
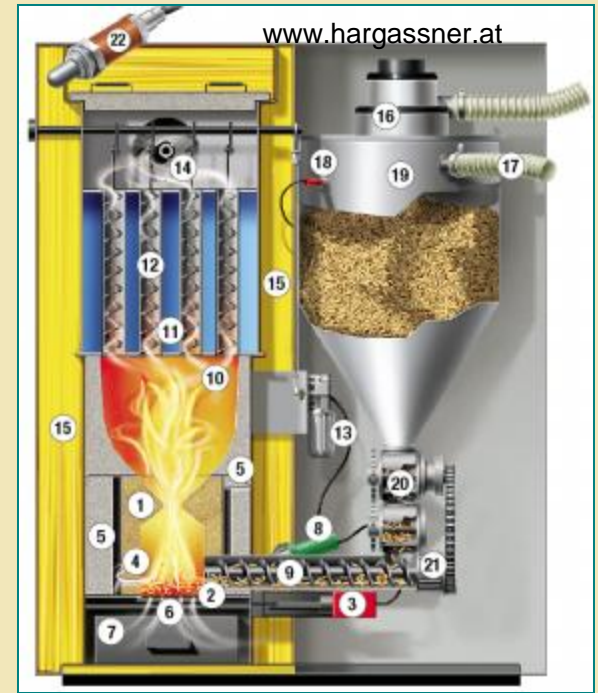
Containerized Units

- Plug and play design
- Integrated fuel storage and boiler housing
- Not just for pellets – chips too
- Considerably lower overall capital costs
- Can be architecturally blended



Boiler Design Features

- Vertical boiler tubes with continual mechanical cleaning (gravity based) in small boilers
- Water lined boiler walls (less boiler jacket loss)
- Longer refractory lined gas routing before heat exchange (longer gas residence time)
- Preheated primary and secondary air



Progress in District Heating

- Six communities pursuing district heating projects in Vermont (Montpelier is getting built)
- Over 300 farmer owned coop district heating plants in the State of Upper Austria! (4,625 mile² versus Montana with 147,042 mile²)



What does it all mean?

- Higher quality fuel = better system performance, lower O&M costs, and lower emissions
- Buffer/accumulator tanks = more constant boiler loads, lower peak loads allowing smaller boiler sizing
- Solar thermal integration = lower heat loads allowing smaller boiler sizing and less wood fuel consumption
- Coupled boilers = better load management and higher efficiencies
- ESPs and Condensing Units = lower fine particulates and happy neighbors and air quality regulators
- Containerized systems = lower capital costs and faster paybacks
- Innovative boiler designs = high thermal efficiencies, cleaner emissions and less maintenance
- District heating = more in the future???

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